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EXAMINER	
REDDING, THOMAS M	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/802,088	Applicant(s) YANG ET AL.
	Examiner Thomas M. Redding	Art Unit 2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/1/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

2. Claim(s) 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows.

Claim 1 and claims 2-20 that depend from it, define a "system" embodying functional descriptive material. Intrinsic evidence from applicant's specification suggests that the claimed "system" is merely a system of software (i.e., a computer

program, or code) in the absence of any hardware devices. Figure 2 depicts the software modules residing in memory, with a corresponding description at specification page 9.

Therefore, claims 1-20 appear to define pure software, deemed "functional descriptive material", not residing on a computer-readable medium or computer-readable memory and is thus non-statutory for that reason (i.e., "When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized" – Guidelines Annex IV). The scope of the presently claimed invention encompasses pure software, which is an abstract idea per se and thus a Judicial Exception, as well as products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests amending the claim(s) to embody the program on "computer-readable medium" or equivalent; assuming the specification does NOT define the computer readable medium as a "signal", "carrier wave", or "transmission medium" which are deemed non-statutory (refer to "note" below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

A "signal" (or equivalent) embodying functional descriptive material is neither a process nor a product (i.e., a tangible "thing") and therefore does not fall within one of the four statutory classes of § 101. Rather, "signal" is a form of energy, in the absence of any physical structure or tangible material.

Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would be non-statutory. In the case where the specification defines the computer readable medium or memory as statutory tangible products such as a hard drive, ROM, RAM, etc, as well as a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests amending the claim to *include* the disclosed tangible computer readable media, while at the same time *excluding* the intangible media such as signals, carrier waves, etc.

If the applicant intended to claim an apparatus rather than a CRM, the examiner suggests modifying the claim language accordingly.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 6, 9, 12, 21, 26, 29, 32, 41, 42 and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by Atashroo (US 5,703,970).

Regarding claims 1, 21, 41, 42, and 44, Atashroo teaches [a] system for efficiently performing a pattern matching procedure, comprising:

an enrollment manager that performs an image conversion procedure for converting an initial reference image into a reference template ("The apparatus may further comprise means for storing the first image at a first time and means for acquiring the second image at a second time later than the first time", Atashroo, column 2, line 64), said image conversion procedure including a binarization procedure or a symmetrical reduction procedure ("The DFT of each row is a complex but symmetric row. Therefore, only the first (N/2+1) points of each row's DFT are stored in the corresponding row as the outputs, thus building a complex array of size M by (N/2+1)", Atashroo, column 4, line 55 and figure 3(b));

and

a verification manager that converts an initial test image into a transformed test image ("Similarly, the second array undergoes a domain transform in a second domain transformer 50", Atashroo, column 4, line 21), said verification manager then combining said reference template and said transformed test image into a correlation image ("The output of the symmetric domain transformer 70 is the real circular cross-correlation function array, i.e., real correlation matrix, of size M by N", Atashroo, column 5, line 44) , said verification manager analyzing matching characteristics of said correlation image to determine whether said initial test image matches said initial reference image ("the

result may be provided to a recognition unit 90 which provides an indication or takes some required action on the basis of the existence of a threshold degree of correlation", Atashroo, column 5, line 49).

Further regarding claim 41, the system described by Atashroo is implemented as a program on a computer ("the computational load for the method according to the invention is of Order ((M*N) log (M*N)) compared with the Order ($(M*N)^2$) for direct method of computing the circular cross correlation function", Atashroo, column 1, line 41). A computer stores its program on computer readable media, thus Atashroo teaches the use of a computer readable medium.

Further regarding claim 42, the means plus element required by this claim, "For example,electronic device 110 may readily be implemented as a computer" (page 8, line 5) is met by the use of a computer to implement the method of Atashroo (see claim 41 above).

Further regarding claim 44, the only new element over claim 1 is the distinction of the system comprising an "electronic device" that performs the procedure. A computer is an electronic device, and Atashroo teaches the use of a computer to implement his method as discussed above.

Regarding claims 6 and 26, Atashroo teaches The system of claim 1 wherein said initial reference image is converted by a Fast Fourier Transform procedure into an

FFT reference image that exhibits symmetrical characteristics across individual complex pixel values, said enrollment manager performing said symmetrical reduction procedure on said FFT reference image to produce a reduced reference image to conserve processing requirements and memory requirements, said FFT reference image being divided during said symmetrical reduction procedure into a reduced portion that is stored as said reference template ("the output of the first domain transformer 40 is half of a complex but symmetric array of size M by N", Atashroo, column 3, last line), and a discarded portion that is not utilized during said pattern matching procedure (Atashroo, column 5, lines 1-18).

Regarding claims 9 and 29, Atashroo teaches [t]he system of claim 1 wherein said enrollment manager converts said initial reference image into an FFT reference image by performing a Fast Fourier Transform procedure upon said initial reference image ("The first and second domain transformers preferably perform real two dimensional fast fourier transforms", Atashroo, column 2, line 55).

Regarding claims 12 and 32, Atashroo teaches [t]he system of claim 1 wherein said verification manager converts said initial test image into an FFT test image by performing a Fast Fourier Transform procedure upon said initial test image("The first and second domain transformers preferably perform real two dimensional fast fourier transforms", Atashroo, column 2, line 55) .

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 2, 3, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larsson et al. (US 2004/0215615 A1) in combination with Atashroo (US 5,703,970).

Regarding claims 2 and 22 Larsson teaches a system to wherein an image capture device provides ~~said~~ [an] initial reference image for creating ~~said~~ a reference template (Larsson, figure 2, references 20 and 23), ~~said~~ [a] pattern matching procedure utilizing said reference template to verify a user identity of a system user corresponding to ~~said~~ [an] initial test image (Larsson figure 4, references 47-50).

Larsson is silent on the details of performing the actual correlation step.

Atashroo does teach a correlation apparatus and method with all the elements of claim 1 as given above.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the improved image correlation technique of Atashroo to perform the correlation functions required by Larsson with speed and efficiency ("the computational load for the method according to the invention is of Order ((M*N) log

(M*N)) compared with the Order ((M*N)^2) for direct method of computing the circular cross correlation function", Atashroo, column 1, line 41).

Regarding claims 3 and 23, the combination of Larsson and Atashroo does teach [an] initial reference image and ~~said~~ [an] initial test image [that] each includes image data that represents a user fingerprint or a user face of a corresponding system user (Larsson figure 2, reference 20).

7. Claims 7 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasrebi et al. (ACM SIGARCH, 1984). (in combination with Atashroo (US 5,703,970).

Regarding claims 7 and 27, Atashroo teaches all the elements of claim 1 as give above, and also teaches said verification manager creates said correlation image by performing a multiplication procedure that multiplies corresponding pixel values from said reference template and said transformed test image to produce correlation pixel values for said correlation image ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays, and, then stores the result in a corresponding position. The output of the multiplier 60 is also a complex array of size M by (N/2+1) that is half of a whole symmetric complex array", Atashroo, column 5, line 2).

Atashroo does not teach that said correlation pixel values being obtained from a multiplication lookup table to conserve system resources such as processing requirements and memory requirements.

Yasrebi et al., working in the same field of endeavor of FFT analysis, teaches correlation pixel values being obtained from a multiplication lookup table to conserve system resources such as processing requirements and memory requirements. ("the results on the different moduli can be stored in look-up tables", Yasrebi, page 22, column 2, paragraph 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a lookup table as taught by Yasrebi in the image correlation system of the combination of Atashroo and Hansche in order to have "the ability to do arithmetic operations such as +, -, and * (in one memory cycle)" (Yasrebi, page 22, column 2, paragraph 4). It also is extremely well known in the field of computer programming, particularly in real-time programming (of embedded systems and the like), to use tables in memory space to gain execution speed by moving computation out of code loops by pre-calculating tables of values and using relatively quick memory accesses in these time critical areas.

8. Claims 4, 5, 10, 11, 13 - 16, 24, 25, 30, 31 and 33 – 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansche (Applied Optics, 1989) in combination with Atashroo (US 5,703,970).

Regarding claims 4 and 24, Atashroo teaches all the elements of claim 1 as given above. Atashroo does not teach a first binarization step to create initial binarization values for said binarization procedure by substituting a decimal value of "1" for all complex coefficients from said initial reference image that are greater than or equal to zero, said enrollment manager also substituting a decimal value of "- 1" for all of said complex coefficients that are less than zero, said initial binarization values then being utilized for any further calculations during said pattern matching procedure.

Hansche, working in the same field of endeavor of pattern matching through correlation in the Fourier domain, does teach a ~~first~~ binarization step to create initial binarization values for said binarization procedure by substituting a decimal value of "1" for all complex coefficients from said initial reference image that are greater than or equal to zero, said enrollment manager also substituting a decimal value of "- 1" for all of said complex coefficients that are less than zero, said initial binarization values then being utilized for any further calculations during said pattern matching procedure ("H_{QPOF} = sgn{Re[$G(w)$} + i * sgn{Im[$G(w)$]}", Hansche, page 4840, column 1, equation 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply the Quad-Phase-Only filter of Hansche to the pattern matching system of Atashroo to take advantage of its "superior discriminatory capability for certain targets (Hansche, page 4833, column 1, 2nd paragraph). It also would provide a filter with the most compact representation practical that would still be able to distinguish between a target and its mirror image.

Regarding claims 5 and 25, the combination of Atashroo and Hansche does not explicitly teach a second binarization step to create stored binarization values for said binarization procedure by substituting a binary value of "1" for all of said complex coefficients from said initial binarization values that are equal to "-1", and by also substituting a binary value of "0" for all of said complex coefficients from said initial binarization values that are equal to "1", said complex coefficients thus each being expressed with a single binary bit, said stored binarization values subsequently being converted into said initial binarization values for performing any required mathematical calculations.

However, it is certainly well known in the computer arts to store or encode data that has two states (e.g. –1 and +1) as binary digits (0 and 1) in order to consume minimal storage space. The assignment of code to symbol is arbitrary as long as it is consistent (Official Notice).

Using this concept, the bipolar information described above in claim 4 would naturally map –1 to 0 and 1 to 1, or alternatively 1 to 0 and –1 to 1.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to add to the Atashroo and Hansche combination given above, a binary encoding scheme to map the two state complex coefficients in the correlation template to "0"s and "1"s to permit compact storage.

Regarding claims 10 and 30, the combination of Atashroo and Hansche teaches a two-step binarization procedure upon said FFT reference image to produce a binarized reference image that is stored with a single binary bit representing each complex pixel value coefficient (Hansche, page 2890, column 1, paragraph 4, and the rejection of claim 5 above).

Regarding claims 11 and 31 the combination of Atashroo and Hansche teaches a symmetrical reduction procedure upon said binarized reference image to produce a reduced reference image which said enrollment manager stores as said reference template (Atashroo, column 4, line 55 and figure 3(b), and Hansche, page 2890, column 1, paragraph 4 as above)

Regarding claims 13 and 33, the combination of Atashroo and Hansche teaches all the elements of claim 12 wherein said verification manager performs a two-step binarization procedure upon said FFT test image to produce a binarized test image that is stored with a single binary bit representing each complex pixel value coefficient (Hansche, page 2890, column 1, paragraph 4, and the rejection of claim 5 above).

Regarding claims 14 and 34, the combination of Atashroo and Hansche teach the elements of claim 13 and a symmetrical reduction procedure upon said FFT test image to produce and store a reduced test image (Atashroo, column 4, line 55 and figure 3(b)).

Regarding claims 15 and 35, the combination of Atashroo and Hansche teach the elements of claim 14 and a complex conjugation procedure upon said reference template to produce a conjugated reference image, said complex conjugation procedure converting each pixel value from said reference template into a corresponding complex conjugate value by inverting an arithmetic operation that connects real and imaginary portions of complex values for said each pixel value from said reference template ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays", Atashroo, column 5, line 2).

Regarding claims 16 and 36, the combination of Atashroo and Hansche teach the elements of claim 15 wherein said verification manager performs a multiplication procedure with said conjugated reference image and said reduced test image to produce a reduced correlation image ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays, and, then stores the result in a corresponding position. The output of the multiplier 60 is also a complex array of size M by (N/2+1) that is half of a whole symmetric complex array", Atashroo, column 5, line 2).

9. Claims 8, 17, 18, 28, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansche (Applied Optics, 1989) and Atashroo (US 5,703,970) in combination with Yasrebi et al. (ACM SIGARCH, 1984).

Regarding claims 17 and 37, the combination of Atashroo and Hansche teach the elements of claim 16. The combination of Atashroo and Hansche is silent on the use of said verification manager performs said multiplication procedure by referencing a multiplication lookup table to index pixel values from said conjugated reference image and said reduced test image to produce corresponding correlation pixel values for said reduced correlation image.

Yasrebi et al., working in the same field of endeavor of FFT analysis teach a multiplication procedure by referencing a multiplication lookup table ("the results on the different moduli can be stored in look-up tables", Yasrebi, page 22, column 2, paragraph 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a lookup table as taught by Yasrebi in the image correlation system of the combination of Atashroo and Hansche in order to have "the ability to do arithmetic operations such as +, -, and * (in one memory cycle)" (Yasrebi, page 22, column 2, paragraph 4). It also is extremely well known in the field of computer programming, particularly in real-time programming (of embedded systems and the like), to use tables in memory space to gain execution speed by moving computation out of code loops by pre-calculating tables of values and using relatively quick memory accesses in these time critical areas.

Regarding claims 18 and 38, the combination of Atashroo, Hansche and Yasrebi teach the elements of claim 17 a symmetrical regeneration procedure upon said reduced correlation image to produce a full FFT correlation image ("Then, as shown in FIG. 4(b), the second half of each row of the resulting array is set using the symmetry property of Fourier Transform to create a supplemented array", Atashroo, column 5, line 27)

10. Regarding claims 8 and 28, the combination of Atashroo, Hansche and Yasrebi teach all the elements of claim 1 as given above.

Atashroo teaches the method of multiplying a transform of a test image by a transform of a template image as part of the process of determining a correlation image.

As described in the rejection of claim 4 above, It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply the Quad-Phase-Only Filter of Hansche to the pattern matching system of Atashroo. It is noted that Hansche teaches constraining each of the transform arrays to 4 possible phase values of "1 + j", "1 - j", "- 1 + j", and "- 1 -j", as suggested by equation 1 (i.e., page 4840, column 1 of Hansche).

Yasrebi, as applied to claim 7 above, teaches the use of a lookup table to improve processing efficiency for mathematical operations in computation.

While the prior art teaches the individual claimed elements, the combination does not describe an actual combination commensurate with the requirements of claim 8, which recites the logical row and column configuration of a lookup table.

However, considering the high skill level and education of one of ordinary skill in the art, (i.e., the Image Processing art), and given that the individual claim elements are taught collectively by the references as described above, the construction and implementation of the lookup table recited in claim 8 would have been obvious to one of ordinary skill in the art. That is, the mere row and column logical arrangement of a lookup table to perform the multiplication of two images represented using binarized complex numbers is well within the skill set of one of ordinary skill in the art, and the arrangement of the claimed lookup table would have been suggested using the common sense, reasoning, and logic commensurate with that skill set. This conclusion, taken in combination with the fact that the prior art teaches each claimed element, whereby the individual elements (i.e., the multiplicative correlation of Atashroo, the binarization of complex number of Hansche, and the look-up table of Yasrebi) could have been combined using known programming and image processing techniques and taken in combination, each element performs as it did separately, whereby the results of the entire combination are completely predictable, leads to the conclusion that the combination as a whole would have been obvious (*KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

11. Claims 19, 20, 39, 40 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansche (Applied Optics, 1989) and Atashroo (US 5,703,970) in combination with Bhagavatula et al. (US 2005/0018925).

Regarding claims 19 and 39, the combination of Atashroo, Hansche and Yasrebi teach the elements of claim 18 and an inverse FFT procedure upon said full FFT correlation image to generate a complex correlation image, said verification manager discarding imaginary values from each pixel value of said complex correlation image to produce a real correlation image ("Only the real component of the result is stored in the corresponding row. The imaginary component of the result will necessarily be zero", Atashroo, column 5, line 40).

The Atashroo, Hansche and Yasrebi combination does not teach said verification manager then performing an FFT shift procedure to generate a correlation graph that represents pixels from said real correlation image.

Bhagavatula does teach a shift procedure to generate a correlation graph that represents pixels from said real correlation image ("one can first locate the position of the face in the smaller resolution image and estimate the correct face region in the high resolution background image, and then shift the crop window and downsample the estimated region containing the face, and then perform verification", Bhagavatula, page 11, paragraph 121)

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the centering technique of Bhagavatula with the image correlation system of Atashroo, Hansche and Yasrebi in order to avoid imposing

position constraints on the user and to improve overall processing speed by focusing on the target of real interest ("To not constrain the user and for purposes of increasing the speed of the overall verification process, it may be desirable to implement a face localizer which locates the face and centers it for the classification", Bhagavatula, page 11, paragraph 121).

Regarding claims 20 and 40, the combination of Atashroo, Hansche, Yasrebi and Bhagavatula teach the elements of claim 19.

The combination does not teach said verification manager computes a peak side-lobe ratio from said correlation graph for comparing with a pre-determined correlation threshold to determine whether said initial test image matches said initial reference image, said peak side-lobe ratio being expressed by a formula:

PSR = (Peak Value - Mean Value) / STD

where said PSR is said peak side-lobe ratio, said Peak Value is a correlation image pixel with a greatest magnitude, said Mean Value is an arithmetical mean value of correlation image pixels in a pre-defined side-lobe area surrounding said Peak Value, and said STD is a standard deviation of said correlation image pixels in said pre-defined side-lobe area.

Bhagavatula further does further teach a verification manager computes a peak side-lobe ratio from said correlation graph for comparing with a pre-determined

correlation threshold to determine whether said initial test image matches said initial reference image, said peak side-lobe ratio being expressed by a formula:

PSR = (Peak Value - Mean Value) / STD

where said PSR is said peak side-lobe ratio, said Peak Value is a correlation image pixel with a greatest magnitude, said Mean Value is an arithmetical mean value of correlation image pixels in a pre-defined side-lobe area surrounding said Peak Value, and said STD is a standard deviation of said correlation image pixels in said pre-defined side-lobe area ("The mean and standard deviation ("σ") of the sidelobe region are computed and used to estimate the PSR using Eq. (2). PSR estimation is depicted pictorially in FIG. 3.

$$PSR = \frac{peak - mean}{\sigma} \qquad (2)$$

", Bhagavatula, page 2, paragraph 16 and equation 2 on page 3).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the centering technique of Bhagavatula with the image correlation system of Atashroo, Hansche, Yasrebi and Bhagavatula since it is a commonly used metric to judge the quality of a correlation ("the peak-to-sidelobe ratio (PSR), is usually employed to measure the peak sharpness", Bhagavatula, page 2, paragraph 16)

Regarding claim 43, the combination of Atashroo, Hansche, Yasrebi and Bhagavatula teach [a] system for efficiently performing a pattern matching procedure, comprising:

$$H_{\mathrm{QPOF}} = \mathrm{sgn}\{\mathrm{Re}[G(\omega)]\} + i \cdot \mathrm{sgn}\{\mathrm{Im}[G(\omega)]\}. \qquad (1)$$

a electronic device that performs an image conversion procedure for converting an initial reference image into a reference template ("The apparatus may further comprise means for storing the first image at a first time and means for acquiring the second image at a second time later than the first time", Atashroo, column 2, line 59, the first image clearing being a pattern or template to be used for comparison purposes), said image conversion procedure including a binarization procedure ("H_{QPOF} = sgn{Re[$G(w)$} + i * sgn{Im[$G(w)$]}", Hansche, page 4840, column 1, equation 1); said electronic device analyzing matching characteristics of a test image and said reference template to determine whether said test image matches said reference template ("The mean and standard deviation ("σ") of the sidelobe region are computed and used to estimate the PSR using Eq. (2). PSR estimation is depicted pictorially in FIG. 3.

$$PSR = \frac{peak - mean}{\sigma} \qquad (2)$$

", Bhagavatula, page 2, paragraph 16 and equation 2 on page 3)..

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Horner (Applied Optics, 1984) teaches binarization of phase in optical correlation and benefits associated with such.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas M. Redding whose telephone number is (571) 270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian P. Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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